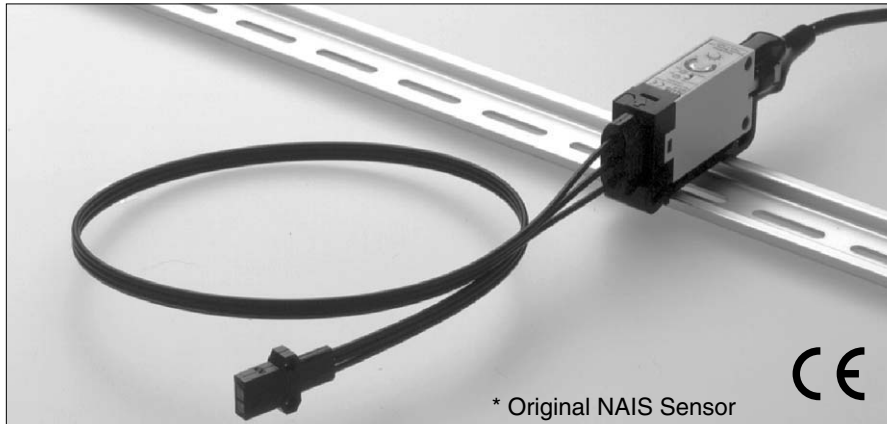


# MQ-FW SERIES

## Trigonometric Area Reflective Optical Fiber Photoelectric Sensor



\* Original NAIS Sensor

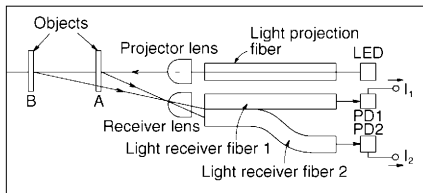
### FEATURES

#### Area reflective beam, fiber type, secures detection of any object

- Detection little influenced by the color, material and surface conditions objects is secured.
  - The tip of the fiber is resistant against dirt.
  - Little influenced by the background beyond the detectable distance.
- Detection is possible under adverse conditions.

#### Detection principles

The detection is determined by comparing the light intensities input into the diodes PD1 and PD2.

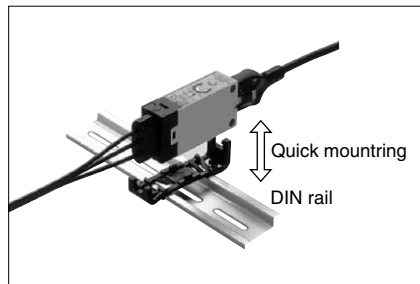


Since the differences between light intensity levels of two photo diodes decide the detection through the triangulation range verification system, detection under slight variation of the distance is secured.

#### Detection position may be checked at a glance because of the visible red spot.

#### High serviceability

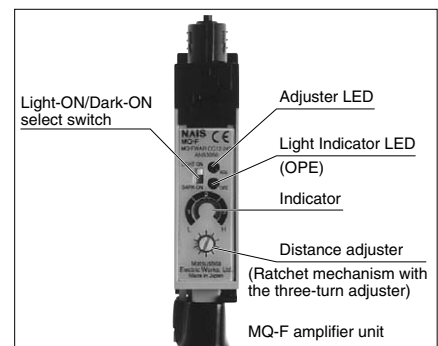
- Mountable on the DIN rail. Side by side mounting with labor-saving is possible.



- The connector terminal structure facilitates simple wiring.

#### Ratchet mechanism with the three-turn adjuster (equipped with the indicator)

- The three-turn adjuster allows fine adjustment of the detectable distance.
- The ratchet mechanism prevents the adjuster from breakage caused by excessive turning.
- Equipped with an indicator which is visible at a glance. Temporary setting of the detectable distance is possible.
- The adjuster LED equipped facilitates setting of the detectable distance.



#### The light-ON and Dark-ON modes are quickly switched.

(equipped with the switch)

#### High speed detection at 1 ms

The detection is possible to 500 times per sec., thus being applicable for high speed devices.

#### Common use for operating voltages of 12 to 24 V DC

Widely applicable over a range of 9.6 V to 30 V DC.

### APPLICATIONS

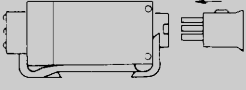
Position detection of silicon wafers, detection of packing on the cap and check of leg pins on electronic parts.

### SENSING RANGES

	Sensing range (cm inch.)	
	1.5 .591	2.5 .984
MQ-FW1 MQ-FW1-01	[Bar chart showing sensing range from 1.5 cm to 2.5 cm]	
MQ-FW2 MQ-FW2-01	[Bar chart showing sensing range from 1.5 cm to 2.5 cm]	

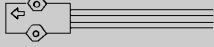
## PRODUCT TYPE

### 1. MQ-FW Amplifier unit

Shape	Rated operating voltage	Light source	Output terminal	Part number	Output
	12 to 24 V DC	Red LED	With connector	MQ-FWAR1-DC12-24V	NPN
				MQ-FWCR1-DC12-24V	PNP
			With cabled connector (cable length: 2 m 6.562 ft.)	MQ-FWAR2-DC12-24V	NPN
				MQ-FWCR2-DC12-24V	PNP

### 2. MQ-FW Fiber unit

Note: Equipped with the DIN rail mountable base.

Shape	Detection method	Range	Fiber length	Part number
	Optical fiber area reflective type	1.5 cm .591 inch	50 cm 1.641 ft.	MQ-FW1
			1 m 3.281 ft.	MQ-FW1-01
		2.5 cm .984 inch	50 cm 1.641 ft.	MQ-FW2
			1 m 3.281 ft.	MQ-FW2-01

### 3. Accessories

Note: Equipped with fiber plug.

Items	Specifications	Part number
MC connector (Tri-terminal type)	With dust protective cover	AN53810
Connector with MC cable (Tri-cord type)	Cable length (2 m 6.562 ft.) with dust protective cover	AN53813

Note: The amplifier main body is equipped with the connector or the cable connector.

## SPECIFICATIONS

### 1. Ratings

Operation side	Rated operational voltage	12 to 24 V DC
	Rated current consumption	35 mA or less (excluding the load)
Load side	Output current capacity	100 mA or less

### 2. Performance

Detection principle	Optical fiber triangulation range measurement method	
Detection method	Optical fiber trigonometric area reflective type	
Type	Amplifier separated DC type	
Amplifier unit part number	MQ-FWAR1-DC12-24V, MQ-FWCR1-DC12-24V (with connector) MQ-FWAR2-DC12-24V, MQ-FWCR2-DC12-24V (with cabled connector)	
Fiber unit part number	MQ-FW1 MQ-FW1-01	MQ-FW2 MQ-FW2-01
Sensing range	15 mm .591 inch	25 mm .984 inch
Detectable distance	10 to 15 mm .394 to .591 inch	20 to 25 mm .787 to .984 inch
Standard target	White drawing paper 2×2 cm .787×.787 inch	
Detectable target	Opaque, translucent	
Hysteresis	5 % or less of the set range	
Operating voltage range	9.6 to 30 V DC ripple (P-P) included	
Response time (freq.)	1 ms or less (500 times per second or less)	
Initial insulation resistance	20 MΩ or more between input/output terminal and external housing (at 500 V DC)	
Initial breakdown voltage	Between input/output terminal and external housing 500 Vrms for 1 min	
Vibration resistance	10 to 55 Hz (1 cycle/min), double amplitude 1.5 mm .059 inch (2 h each on 3 axes)	
Shock resistance	980 m/s <sup>2</sup> {approx. 100 G} (6 times each on 3 axes)	
Protective construction	Amplifier	Plastic case, dust-protected construction (equivalent to IEC IP50)
	Fiber tip	Splash-protected type (equivalent to IEC IP64)
Usable ambient light level	Incandescent lamp	3,000 lux or less
	Sunlight	10,000 lux or less
Ambient temperature	Amplifier	-25 to +55°C -13 to +131°F (non-icing condition)
	Fiber	-40 to +70°C -40 to +158°F (non-icing condition)
Ambient humidity	85% or less RH (non-condensing condition)	
Indicator	OPE. (operation) indicator: red LED Adjust indicator: red LED	
Light source	Red LED	
Fiber material	Urethane-chloroethylene copolymerization shielded, plastic fiber	
Bending allowance of fiber unit	25 mm .984 inch	

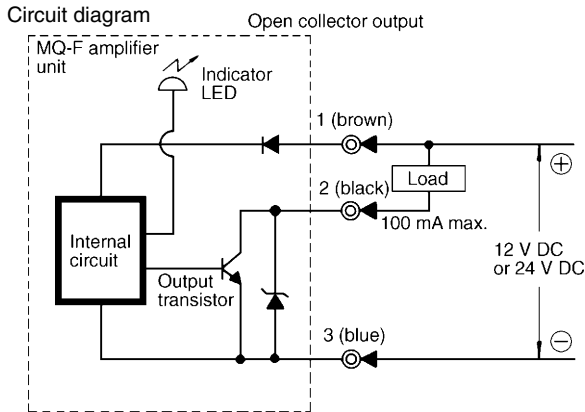
Note: Unless otherwise specified, the measurement conditions comprise rated operating voltage, power supply by battery, 20°C 68°F ambient temperature, standard detectable object and 200 lux or less illuminance on the receiver surface.

# MQ-FW

## 3. Output circuit diagram

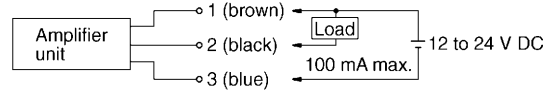
## Wiring diagram

### NPN output type



Colors are applicable for the cabled connector.

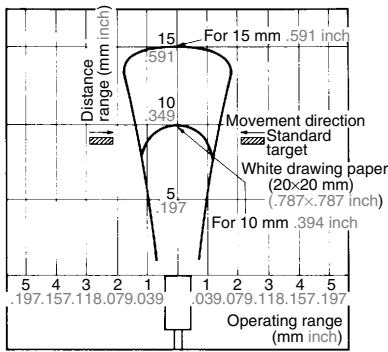
### MQ-F amplifier unit



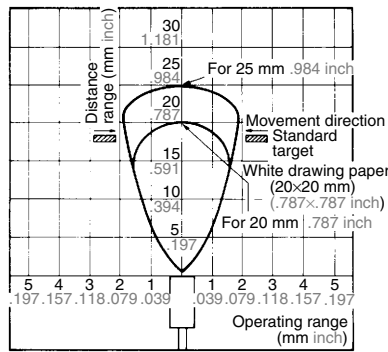
Note: The colors are applicable for the cabled connector.

## DATA

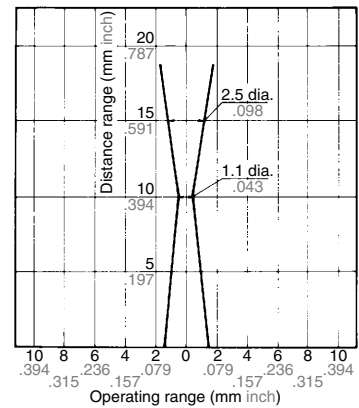
### 1. Operating range characteristics MQ-FW amplifier unit MQ-FW1 fiber unit (1.5 cm .591 inch)



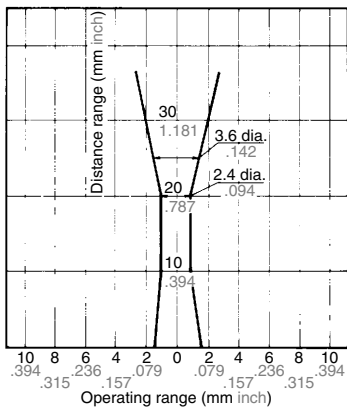
### MQ-FW amplifier unit MQ-FW2 fiber unit (2.5 cm .984 inch)



### 2. Projector beam dia. characteristics MQ-FW amplifier unit MQ-FW1 fiber unit (1.5 cm .591 inch) The beam diameter is regarded as the diameter which attenuates at $1/e^2$ (Here $e \approx 2.72$ )

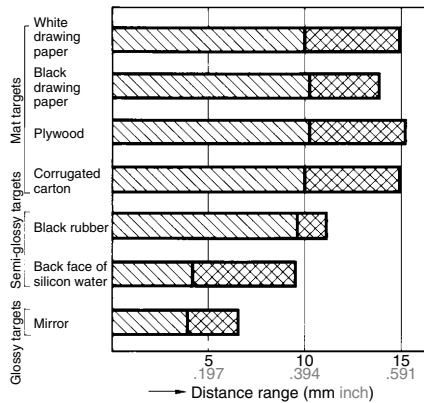


### MQ-FW amplifier unit MQ-FW2 fiber unit (2.5 cm .984 inch)



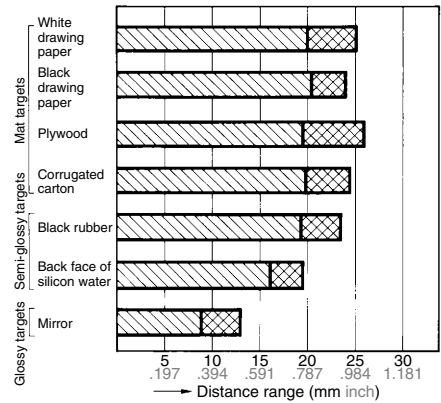
### 3. Material characteristics MQ-FW amplifier unit MQ-FW1 fiber unit (1.5 cm .591 inch)

- ☒: Under the standard condition that white drawing paper is detected at 15 mm .591 inch distance.
- ☑: Under the standard condition that white drawing paper is detected at 10 mm .394 inch distance.



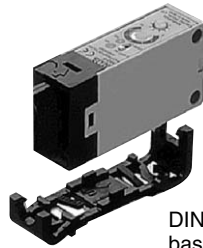
### MQ-FW amplifier unit MQ-FW2 fiber unit (2.5 cm .984 inch)

- ☒: Under the standard condition that white drawing paper is detected at 25 mm .984 inch distance.
- ☑: Under the standard condition that white drawing paper is detected at 20 mm .787 inch distance.



## DIMENSIONS

MQ-FWAR amplifier unit



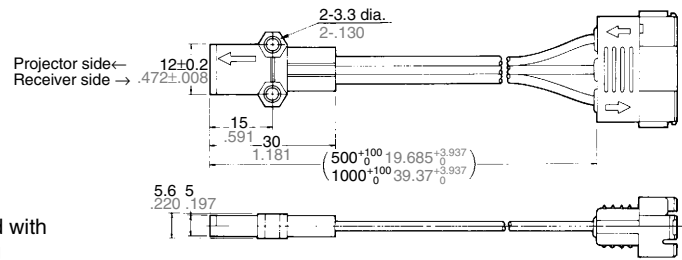
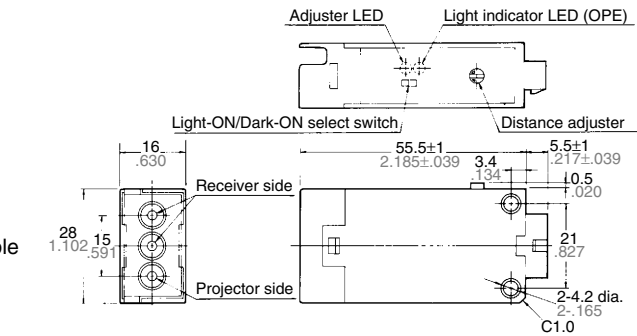
DIN rail mountable base

\*Equipped with the base mountable on DIN rail.

MQ-FW1 fiber unit



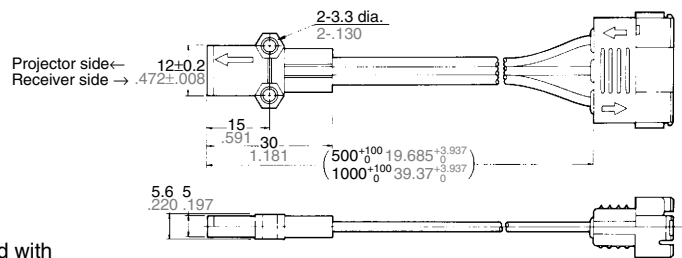
\*Equipped with fiber plug



MQ-FW2 fiber unit



\*Equipped with fiber plug



General tolerance: ±0.5 ±.020

## CAUTIONS

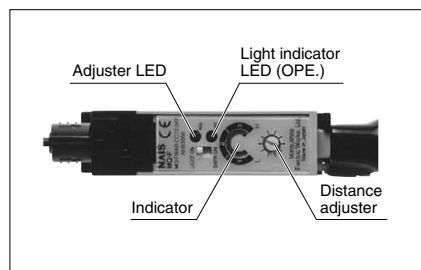


These products are **not** safety sensors and are **not** designed or intended to be used to protect life and prevent bodily injury or property damage.

### 1. Distance adjustment for the area reflective type

- 1) Facing the fiber unit in the detection direction, temporarily fasten it.
- 2) Under the condition that no detectable object exists, gradually turn the distance adjuster counterclockwise from the maximum position (H) to find the position where the light indicator LED (OPE.) goes out. When the LED goes out even if the adjuster is in the max. position (H), select the H position.
- 3) Place a detectable target in the detection position, and gradually turn the distance adjuster clockwise from the minimum position (L) to find the position where the light indicator LED (OPE.) comes on. When the LED turns ON even if the adjuster is in the min. position (L), select the L position.
- 4) Set the adjuster at the middle point between the positions selected in step 2) and step 3).

- 5) Securely fasten the head of the fiber unit. During fastening, take care to secure it to an extent that it is not displayed when vibration or shock is applied. Note: Though the distance range is little

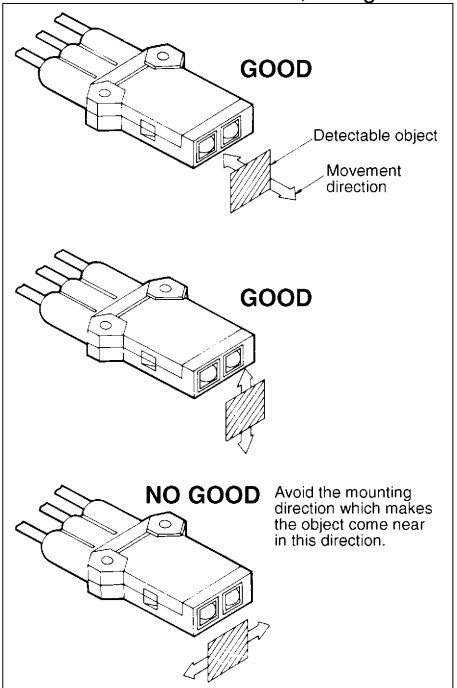


influenced by the colors of objects, the detectable distance may vary for considerably reflective objects such as mirrors, glass and other mirror reflective objects.

### 2. Movement direction of detectable target

Take care for the mounting direction of the fiber unit according to the movement direction of an object.

For the ambient conditions, wiring and



operation of the fiber unit, refer to the cautions for operation.

# MQ-FW

## Accessories

MC connector  
Three-terminal type  
AN53810

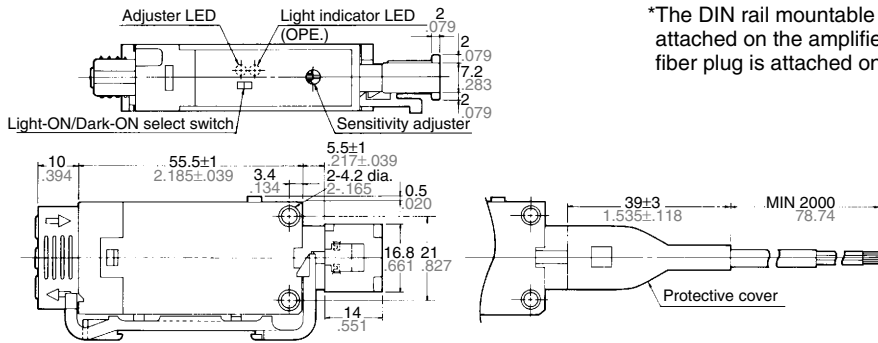
Connector with MC cabled connector  
(Cable length: 2 m 6.562 ft.)  
Three-code cable  
AN53813

Terminal No. (code)	Description
1 (—)	⊕ terminal
2 (≡)	● terminal
3 (≡)	⊖ terminal

Terminal No. (Color code)	Description
1 (brown)	⊕ terminal
2 (black)	● terminal
3 (blue)	⊖ terminal

## Amplifier Mounting Dimensions

mm inch

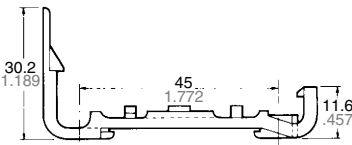
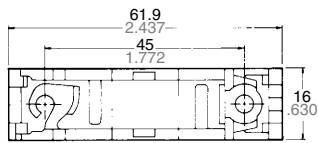


\*The DIN rail mountable bracket and connector are attached on the amplifier on the amplifier unit, and the fiber plug is attached on the fiber unit respectively.

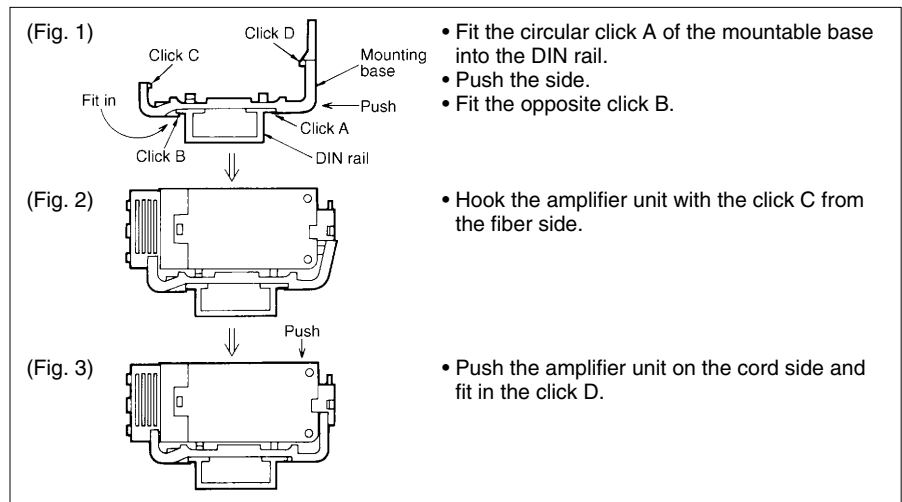
General tolerance: ±1 ±.039

## Bracket Dimensions

- Direct mounting on the chassis
  - 1) When mounting the DIN rail mountable bracket, use two M4 pan head screws. (Keep in mind that the hex. recessed cap bolts can not be used as the mounting fasteners.)
  - 2) For the screw pitch, see the following view. (Pitch: 45 mm 1.772 inches)
  - 3) To fasten the amplifier main body, use M4 screws on the flat surface and combine the screw with the plain or spring washer, and tighten the screw to a torque of 10 kg-cm or less.



- Mounting on the DIN rail
  - 1) Use the 35 mm 1.378 inches wide DIN rail (DIN EN5002).
  - 2) Mount the unit as shown below.

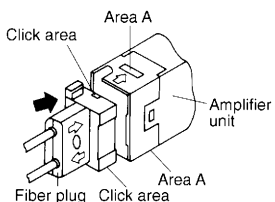


Notes: 1. To remove the amplifier unit, bend the click D of the mountable bracket toward outside.  
2. When vertically mounting the DIN rail, face the fiber side upward.

## Attachment and Detachment of Fiber Plug

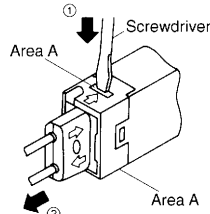
- To attach the fiber plug on the fiber plug
 

Push the fiber plug in the arrow direction as far as the upper and lower clicks of the fiber plug are securely engaged on the upper and lower areas A of the amplifier unit.



- To detach the fiber plug from the amplifier unit
 

Lightly push the upper and lower areas A of the amplifier unit with a screwdriver or similar to disengage the click area of the fiber plug. Then, pull out the fiber plug.  
Note: Take care not to excessively push the area A, or the click area of the fiber plug will be sometimes broken.



## CAUTIONS

### 1. Environmental conditions

#### • Amplifier unit

- 1) The ambient temperature shall be kept within a range of  $-25^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$   $-13^{\circ}\text{F}$  to  $131^{\circ}\text{F}$ .
- 2) The operational voltage shall be kept within a range from 9.6 V to 30 V DC (including ripple P-P).
- 3) Use a surge absorber as the internal circuit may be damaged if external surge voltages exceed 500 V  $[\pm(1.2 \times 50) \mu\text{s}$  single polarity full-wave voltage].
- 4) Use a load relay with a rated operating voltage of 12 V DC or 24 V DC. The voltage applied to the load relay is the operating voltage of the photoelectric sensor minus the internal voltage drop (max. 1.2 V). Voltage fluctuation should be taken into account.

#### • Fiber unit

- 1) The ambient illuminance shall be 3,000 lux or less at the receiver under an incandescent lamp, and 10,000 lux or less at the receiver under sunlight.
- 2) The unit shall not be used at the site where much steam, dust or corrosive gas is suspended, water or oil splashes directly over the unit, or organic solvent adheres to the unit.

### 2. Wiring

#### • Amplifier unit

- 1) Check all wiring before applying power since incorrect wiring may damage the internal circuit.
- 2) Keep in mind that the output area is broken if a load of 100 mA or more is connected.

3) Keep in mind that the induction noises cause malfunction and breakage if the wiring to the photoelectric sensor runs with the high voltage cables and the power cable.

4) When crimping the terminals, use the following tool made by Molex.

Crimping	Insertion	Pulling-out
JHTR1719C	J5800-001	J5800-002

Here, the terminal is 5005 TL made by Molex and the receptacle is 5025-03R1.

5) When extending the cable, use a cable of  $0.3 \text{ mm}^2$  ( $.0005 \text{ in}^2$ ) or more and limit its length within 100 m 328 ft.

6) When connecting the receptacle to the plug of the photoelectric sensor, properly connect them and securely push in the plug as far as the lock mechanism is activated. The construction to prevent reverse connection is provided.

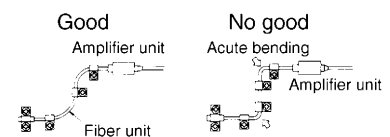
To remove the receptacle, release the lock mechanism and pull out the plug with the receptacle held by hand.

7) It is recommended to attach an auxiliary dust protective cover to the receptacle.

8) When the commercially available switching regulator is used, ground FG (frame ground terminal) and G (ground terminal). Otherwise, the switching noise of power supply may sometimes cause malfunction. In this case, care shall be taken.

### 3. Handling of the fiber unit

- 1) The fiber unit shall be securely equipped on the amplifier.
- 2) Do not tighten with an excessive strength. Apply a torque of 8 N·m {78.4 kgf·cm 68.048 lbf·in} or less tightening.
- 3) Do not apply a pulling force of 3 kg or more to the fiber unit.
- 4) Make the bending curvature of the fiber as large as possible. If the curvature is small, the transmission factor is reduced. So, check this during actual operation. (The curvature shall be R25 mm or more).
- 5) Largely bend the fiber and do not bent it at the root.



6) Do not compress the fiber or apply a load to it.

